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THE EFFECTS OF THE TRANSCENDENTAL MEDITATION AND TM-SIDHI PROGRAM ON THE AGING PROCESS

ROBERT KEITH WALLACE, MICHAEL DILLBECK, ELIHA JACOBE and BETH HARRINGTON

Departments of Biology and Psychology,
Maharishi International University, Fairfield, Iowa 52556

The Transcendental Meditation and TM-Sidhi programme was found to reverse the ageing process. The mean biological age of short-term meditators was found to be 5 years younger, and that of long-term meditators 12 years younger, than expected from population norms. A correlation was found between length of time practising the Transcendental Meditation programme and younger biological age.—EDITORS

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To evaluate the effects of the Transcendental Meditation (TM) and TM-Sidhi program on the aging process, a standardized test of biological aging, utilizing auditory threshold, near point vision, and systolic blood pressure, was given to a cross-sectional group ($N = 84$) with a mean age of 53 years. There were 11 controls, 33 short-term TM and TM-Sidhi participants, and 40 long-term participants. The mean biological age of the controls was 2.2 years younger than for the general population; of the short-term TM subjects, 5.0 years younger; of the long-term TM subjects, 12.0 years younger. The difference between the groups was significant covarying for a diet factor. Also, there was a significant correlation between length of time practicing the TM program and biological age ($r = -0.46$). Together with numerous physiological and psychological studies conducted on the TM and TM-Sidhi program, this study suggests that the TM program may affect certain neural mechanisms which in turn influence age-correlated physiological variables.

A number of neurophysiological studies have demonstrated the importance of experience in the development and aging of animals (Bennett *et al.*, 1964; Blackemore & Cooper, 1970; Cummins *et al.*, 1973; Connor *et al.*, 1980). Studies on human aging have further shown that mental health and certain types of mental experience are correlated with aging and longevity (Palmore, 1974; Buell & Coleman, 1979; Vaillant, 1979). Recent studies have found that subjects practicing the Transcendental Meditation (TM) and TM-Sidhi program reported a unique type of experience known as "pure consciousness" (Orme-Johnson & Haynes, 1981; Dillbeck *et al.*, 1981; Farrow & Hebert, 1981) and that accompanying this experience are a number of short- and long-term physiological and biochemical changes which are suggested to be beneficial to health and possibly longevity.

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For example, a longitudinal improvement after practicing the TM technique has been reported in patients with hypertension and hypercholesterolemia (Benson & Wallace, 1972a; Cooper & Aygen, 1979). Reduction in cigarette smoking and alcohol consumption with the TM technique have also been reported (Benson & Wallace, 1972b). Changes in physical function include a wide range of results such as: enhanced perceptual ability, faster reaction time, changes in brainstem auditory evoked potentials, and improvements in patients with bronchial asthma as measured by increased forced expiratory volume, peak expiratory flow, and airway resistance (Pelletier, 1974; Appelle & Oswald, 1974; McEvoy *et al.,* 1980; Wilson *et al.,* 1975).

While the above studies do not concern themselves directly with the aging process they provide strong circumstantial evidence for the potential beneficial effects of the TM technique on aging. To measure more directly these effects the present study was designed to test the following two hypotheses: (1) that participants in the TM program will be biologically younger than norms for the general population; and (2) that this difference will be greater in individuals who have been practicing the TM technique for a longer period of time.

METHOD

Background

The effects of aging on physical and mental functions have been shown in a number of studies (Shock, 1962; Palmore, 1974; Corso, 1971). These studies have reported gradual and distinct changes in morphological characteristics such as standing height, weight, skinfold thickness and in specific physiological and psychological functions such as basal and maximal oxygen consumption, blood pressure, vital capacity, auditory thresholds, and specific measures of intelligence. Further, they clearly indicate that individuals age at different rates and demonstrate the need for a description of biological age as distinct from chronological age.

A major challenge in aging research has been to develop a measure of the aging process which is determined by physiological functioning. A number of attempts have been made to develop instruments which would measure biological age effectively. The results have evinced varying degrees of complexity, ease of administration, and utility of results and have been critically evaluated by researchers (Murray, 1951; Clark, 1960; Hollingsworth *et al.,* 1965; Heron & Chown, 1967; Costa & McCrae, 1980). In this study the Adult Growth Examination developed by Morgan (Morgan & Fevens, 1972) was used because of both its practicality and its reported reliability and validity, and was administered to a cross-sectional group of short- and long-term participants in the TM and TM-Sidhi program and to nonmeditator controls.

The procedures and norms of the Adult Growth Examination were derived in part from the United States National Health Survey, which includes a carefully selected representative cross-sample of several thousand adults, and has been validated in studies conducted in the United States and Canada (Morgan & Fevens, 1972). The test includes three basic subtests which utilize measurements of auditory threshold, near vision, and systolic blood pressure and which have been reported by Morgan to be the most reliable and easily measured indicators of biological aging.

Subjects

Volunteer subjects were recruited from university staff and visitors and from individuals in the community through an article on biological aging in the local newspaper. Only subjects between the ages of 40 and 64 were studied.

A total of 84 subjects, 38 men and 46 women, participated in the study. The controls included 11 subjects (5 men and 6 women) with a mean age of 54.2 years (SD = 8.8) who did not practice the TM program. The remaining 73 subjects, 33 men and 40 women, acted as the meditating experimental group. Their mean length of TM practice was 62 months, ranging from 1 week to 181 months. The experimental group was divided at the approximate mean length of TM participation (5 years) into a short-term group (n = 33) and a long-term group (n = 40). The mean lengths of TM participation for these groups were 34 and 85 months, respectively. The short-term group consisted of 15 men and 18 women with a mean age of 52.2 years (SD = 6.8), while the long-term group consisted of 18 men and 22 women with a mean age of 53.3 years (SD = 6.9). The mean ages of the three groups were not significantly different.

The TM sample included persons practicing the TM-Sidhi program, a set of advanced meditation procedures which may be learned after a TM participant has practiced the TM technique for at least six months.Eleven of the short-term TM participants and 22 of the long-term participants had learned some or all of the TM-Sidhi program. Those in the short-term TM group had either recently completed the TM-Sidhi instruction or were only part way through the TM-Sidhi courses. Practice of the TM-Sidhi program in the long-term TM group ranged widely from partial training to two years of experience with the full program.

Testing Procedure

All subjects were given the three-subtest version of the Adult Growth Examination and tested at the same time on two separate days.

Auditory thresholds were measured with a General Radio model no. 1937 audiometer of 6000 Hz for the better ear after a rehearsal at 1000 Hz. Thresholds were ascertained at the lowest level which yielded correct identification of tones half the time. Near vision thresholds were measured with a simple apparatus (Morgan & Fevens, 1972) which measured the distance for uncorrected binocular vision at which a sentence in ordinary newsprint-size characters (pica: 12 letters per inch) could be read without blurring. Systolic blood pressure was measured with a standard mercury sphygmomanometer with the appearance of the first heart sound taken as systolic pressure. The value used was the average of three readings, made at rest in the sitting position, separated by the intervening activity of the other subtests.

The average of the two days' reading for each subtest was then converted to a biological age score and the median score from the three subtests was taken to be the biological age, according to Morgan & Fevens (1972). A significant and high correlation between total biological age score and chronological age of 0.82 has been reported by Morgan & Fevens (1972). Also, medians derived from any two subtests were reported to be correlated significantly with age.

Morgan suggests when it is not possible to use one of the subtests, for example in the case of subjects taking medication for high blood pressure or in the case of blindness, that the biological age may be derived as the mean of two of the three subtests. Test-retest correlations for any two subtest combinations were reported to be very high and significant (0.81 to 0.95) and nearly as reliable as the full test. In this study two control and one long-term experimental subjects were taking antihypertensive medication. They were scored only on the vision and hearing subtests. One long-term experimental subject had cataracts and was scored only on the blood pressure and hearing subtests.

At this initial testing session subjects were asked to complete a brief questionnaire on health, socioeconomic status, and diet and exercise habits. A second, more extensive, questionnaire on diet and exercise was also mailed to all subjects.

RESULTS

The mean age difference score (difference between biological and chronological age) for the control subjects was -2.2 ($SD = 8.69$), for the short-term TM sample -5.0 ($SD = 8.93$), and for the long-term TM group -12.0 ($SD = 8.91$) (Figure 1). These means were in the predicted direction and a one-way ANOVA indicated that the difference between groups was significant, $F(2,81) = 8.30, p<0.01, \omega^2 = 0.144$. The two hypotheses described earlier were expressed as the following *a priori* orthogonal comparisons: between the short-term TM group and controls, and between the long-term TM group and both the short-term TM sample and controls. However,

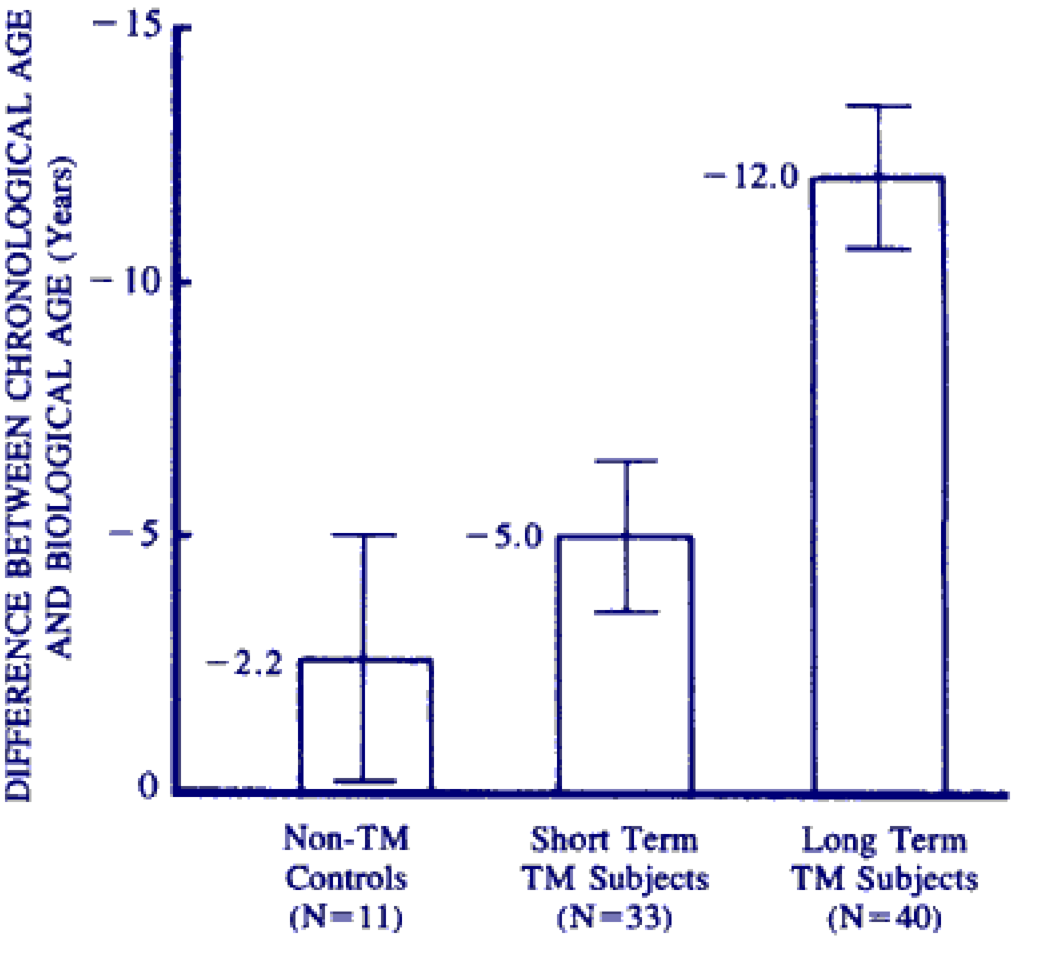

FIGURE 1 Mean and standard error for the difference between biological age and chronological age by group, unadjusted for diet. One-way ANOVA, $F(2,81)=8.30$, $p<0.01$, $\omega^2=0.144$.

before performing these comparisons, preliminary analyses were made of the questionnaire items pertaining to exercise and diet patterns in order to control for possible confounding factors. Two subjects in the short-term TM group did not respond to the questions on exercise and diet.

To assess the possible effect of exercise, a one-way ANOVA compared the three levels of vigorous exercise reported by subjects (none, occasional, or regular). The dependent variable was the age difference score. This ANOVA for exercise was not significant, $F(2,79)<1$. On the basis of this result exercise was not included as a covariate in the major analyses.

Subjects responded to a diet question which categorized their diet as one of the following: (1) including red meat ($n=38$); (2) including fish and fowl but not red meat ($n=31$); (3) including eggs but not fish, fowl, or red meat ($n=5$); (4) excluding eggs, fish, fowl, and red meat ($n=8$). All the subjects not consuming red meat (the last three diet groups) were members of the TM groups, 37 of whom reported changing their diet since learning the TM program. To assess whether diet should be used as a covariate, a one-way ANOVA compared the age difference score across the four levels of diet. A significant effect was obtained, ($F(3,76) = 4.70$, $p<0.01$, $\omega^2=0.116$. The respective means for the groups were -4.03 ($SD = 9.52$), -11.87 ($SD = 9.28$), -9.60 ($SD = 4.04$), -11.00 ($SD = 7.17$). *Post hoc* comparisons using Tukey HSD procedure indicated that none of the differences between the four groups were significant at the 0.05 level. Because of the similarity of the means of the three "nonmeat" groups in comparison to the meat group, a *t*-test was run between the first group and the other groups combined. This test was significant, $t(80) = 3.75$, $p<0.01$, $\omega^2=0.134$. There was no significant correlation between age difference scores and number of years without red meat, nor was there evidence of curvilinear relationship between these variables. As a result of this diet effect, a dichotomous variable denoting use or nonuse of red meat was used as a covariate for the major analyses which follow.

The primary analysis was a one-way ANCOVA on the age difference score for long-term TM participants, short-term TM participants, and controls, covarying for use of red meat. This analysis was significant in the predicted direction, with adjusted group means of -4.73, -5.46, and -10.91 for controls, short-term meditators, and long-term meditators, respectively, $F(2,78) = 3.33$, $p<0.05$, $\omega^2 = 0.053$. The planned comparisons indicated that the long-term meditators differed from both the short-term meditators and controls, $F(1,78) = 5.79$, $p<0.025$, $\omega^2= 0.054$, while the difference between the short-term meditators and controls was not significant, $F(1,78)<1$.

Although the major hypothesis of the study was to assess the effect of the TM program on age difference scores, the partially confounded relationship between diet and TM program participation may raise the question as to the effect of diet on the age difference variable independent of the TM program. To assess this, an analysis of variance was performed on this variable between the two diet groups (use and nonuse of red meat), covarying for length of time practicing the TM program. This analysis did not reach significance $F(1,79) = 1.51$, $p<0.10$, $\omega^2 = 0.006$. When this same analysis was performed covarying for TM group membership (long-term, short-term, and control), the effect of diet was significant, $F(1,79) = 6.06$, $p<0.05$, $\omega^2 = 0.057$. It is meaningful to note that in the ANCOVA for the effect of TM groups on age difference score covarying for use or nonuse of red meat, the main effect of the TM group accounted for 5.3% of the variance. If we then take the analysis of the effect of use or nonuse of red meat covarying for TM group membership as the comparable analysis to assess the proportion of variance accounted for by diet (5.7%), then the effects of the two factors appear comparable. However, when covarying for months of practice of the TM technique, the diet variable accounted for only 0.6% of the variance in age difference scores; the TM group effect was not assessed covarying for months without red meat use because this time variable was not related to the age difference scores. Finally a correlation was determined between the age difference score (the difference between the biological and chronological ages) of each experimental subject and the length of time the subject had practiced the TM program and was found to be significant ($r = -0.46$, $p<0.001$).

DISCUSSION

The results indicate that the long-term TM meditators have a significantly younger mean biological age than short-term meditators, controls, and norms for the general population, and the strength of this effect is related to the length of practice of the TM technique. Further statistical analysis indicated that while subjects who excluded red meat did have younger biological ages (these were also TM participants), the effect of the TM program was independent of diet; however, the diet effect was not significant when covarying for months of TM participation. A longitudinal study involving random assignment of subjects would help to clarify the effects of preselection, attrition, and also diet.

Several previous studies have demonstrated short- and long-term changes as a result of the TM technique (Wallace, 1970; Wallace *et al.*, 1971; Orme-Johnson & Farrow, 1977; Benson & Wallace, 1972a, 1972b; Jevning *et al.*, 1978a, 1978b; Cooper & Aygen, 1979; Glueck & Stroebel, 1978; Wilson *et al.*, 1975). More recent studies, as mentioned before, on the advanced TM-Sidhi program have correlated the magnitude of these physiological changes with the subjectively reported experience of "pure consciousness" (Orme-Johnson *et al.*, 1981; Farrow & Hebert, 1981). The results of these and other cross-sectional studies have led different researchers to suggest that the experience of the TM and TM-Sidhi programs and their accompanying physiological state affect central nervous system functioning and this in turn influences physical and mental performance.

For example, it has been suggested that there is reduction in sympathetic tone as a result of the TM technique which leads to reduction in high blood pressure (Wallace *et al.*, 1971; Benson & Wallace, 1972a). It has also been suggested that better performance on perceptual measures as a result of the TM and TM-Sidhi program are a result of an enhancement of signal to noise ratio in information processing in the central nervous system (Clements & Milstein, 1976; McEvoy *et al.*, 1980). Greater autonomic stability found in TM participants has been suggested as the basis for faster recovery from stressful stimuli (Orme-Johnson, 1973; Goleman & Schwartz, 1976).

While the precise physiological mechanisms involved need to be further elucidated, the findings of this and other studies suggest that the experience of the TM and TM-Sidhi program affects the aging of specific autonomic and sensory processes and thereby results in significantly younger biological ages in long-term meditators.

REFERENCES

Appelle, S. & Oswald, L.E. Simple reaction time as function of alertness and prior mental activity. *Perceptual and Motor Skills,* 1974, **38**, 1263 – 1268.

Bennett, E.L., Diamond, M.C., Krech, D., & Rosenzweig, M.R. Chemical and anatomical plasticity of the brain. *Science*, 1964, **146**, 610 – 619.

Benson, H. & Wallace, R. K. Decreased blood pressure in hypertensive subjects who practiced meditation. *Circulation,* 1972(a), *Supplement II to 45 & 46,* 516.

Benson, H. & Wallace, R. K. Decreased drug abuse with Transcendental Meditation: A study of 1,862 subjects. In C. J. D. Zarafonetis (Ed.), *Drug Abuse: Proceedings of the International Conference.* Philadelphia: Lea and Febiger, 1972(b).

Blackemore, C.J. & Cooper, G.E. Development of the brain depends on the visual environment. *Nature,* 1970, **228**, 477 – 478.

Buell, S. & Coleman, D. Dendritic growth in the aged human brain and failure of growth in senile dementia. *Science*, 1979, **206**, 854 – 856.

Clark, J. The aging dimension: A factorial analysis of individual differences with age on psychological and physiological measurements. *Journal of Gerontology,* 1960, **15**, 183 – 188.

Clements, G. & Milstein, S.L. Auditory thresholds in advanced participants in the Transcendental Meditation program. In D.W. Orme-Johnson & J.T. Farrow (Eds.), *Scientific Research on the Transcendental Meditation Program: Collected Papers, Vol.* **1**. West Germany: Meru Press, 1976.

Connor, J.R., Diamond, M.C., & Johnson, R.E. Occipital cortical morphology of the rat: Alteration with age and environment. *Experimental Neurology*, 1980, **68**, 158 – 170.

Cooper, M. & Aygen, M. A relaxation technique in the management of hypercholesterolemia. *Journal of Human Stress*, 1979, **5**(4), 24 – 27.

Corso, T.F. Sensory processes and age effects in normal adults. *Journal of Gerontology*, 1971, **26**, 90 – 105.

Costa, P.T.J. & McCrae, R.R. Functional age: A conceptual and empirical critique. *Proceedings of the NIA Conference on Epidemiology of Aging.* 1977. U.S. Government Printing Office, Washington, D.C., 1980.

Cummins, R.A., Walsh, R.N., Buatz-Olsen, O.E., Konstantinos, T. ,& Horsfall, F.R. Environmentally induced changes in the brain of elderly rats. *Nature*, 1973, **516**, 518.

Dillbeck, M.C. & Bronson, E.C. Short-term longitudinal effects of the Transcendental Meditation technique on EEG power and coherence. *International Journal of Neuroscience,* 1981, in press.

Farrow, J.T. & Hebert, J.R. Breath suspension during the Transcendental Meditation technique. *Psychosomatic Medicine*, in press.

Glueck, B.C. & Stroebel, C.F. Physiological correlates of relaxation. In A.A. Sugarman & R.E. Tarter (Eds.), *Expanding Dimensions of Consciousness.* New York: Springer Publishing, 1978.

Goleman, D.J. & Schwartz, G.E. Meditation as an intervention in stress reactivity. *Journal of Consulting & Clinical Psychology*, 1976, **44**, 456–466.

Heron, A. & Chown, S. *Age and Function.* London: J. and A. Churchill Ltd., 1967.

Hollingsworth, J.W., Hashizume, A., & Jablon, S. Correlations between tests of aging in Hiroshima subjects—an attempt to define physiologic age. *Yale Journal of Biological Medicine*, 1965, **38**, 11–26.

Jevning, R., Wilson, A.F., Smith, R.R., & Morton, M.E. Redistribution of blood flow in acute hypometabolic behavior. *American Journal of Physiology*, 1978, **235**, 89–92.

Jevning, R., Wilson, A.F., & Davidson, J.M. Adrenocortical activity during meditation. *Hormones and Behavior*, 1978, **10**, 54–60.

McEvoy, T.M., Frumkin, L.R., & Harkings, S.W. Effects of meditation on brain-stem auditory evoked potentials. *International Journal of Neuroscience*, 1980, **10**, 165–170.

Morgan, R.F. & Fevens, S.K. Reliability of the adult growth examination: A standardized test of individual aging. *Perceptual and Motor Skills,* 1972, **34**, 415–419.

Murray, I.M. Assessment of physiological age by combination of several criteria: Vision, hearing, blood pressure, and muscle force. *Journal of Gerontology*, 1951, **6**, 120–126.

Orme-Johnson, D.W. Autonomic stability and Transcendental Meditation. *Psychosomatic Medicine,* 1973, **35**, 341–349.

Orme-Johnson, D.W. & Haynes, T.W. EEG phase coherence, pure consciousness, creativity and TM-Sidhi experience. *International Journal of Neuroscience*, 1981, **13**, 211–217.

Orme-Johnson, D.W. & Farrow, J. *Scientific Research on the Transcendental Meditation Program. Collected Papers, Vol.1.* Rheinweiler, West Germany: Maharishi European Research University Press, and Livingston Manor, NY: Maharishi International University Press, 1977.

Palmore, E. (Ed.). *Normal Aging II.* Durham, NC: Duke University Press, 1974.

Pelletier, K.R. Influence of Transcendental Meditation upon autokinetic perception. *Perceptual and Motor Skills*, 1974, **39**, 1031–1034.

Shock, N.W. The physiology of aging. *Scientific American*, 1962, **206**, 100–110.

Vaillant, G.E. Natural history of male psychologic health. *New England Journal of Medicine*, 1979, **301**, 1249–1254.

Wallace, R.K. Physiological effects of Transcendental Meditation. *Science*, 1970, **167**, 1751–1754.

Wallace, R. K., Benson, H., & Wilson, A. F. A wakeful hypometabolic physiologic state. *American Journal of Physiology*, 1971, **221**, 795–799.

Wilson, A.F., Honsberger, R., Chiu, J.J., & Novey, H.S. Transcendental Meditation and asthma. *Respiration*, 1975, **32**, 74–80.

PAPER **243**

TRANSCENDENTAL MEDITATION—TREATING THE PATIENT AS WELL AS THE DISEASE

H. DAVID LOVELL-SMITH, BA, MB, CHB

The Transcendental Meditation programme is discussed as a scientifically validated method with a wide range of benefits for the promotion of positive health. The discussion is illustrated by a case report.—EDITORS

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